Instruction

875 Series Intelligent Analyzers

**Operation, Configuration, and Calibration
Using a HART Communicator**

Invensys®

FOXBORO®

Contents

1. General Information

Description

The 875 Series Analyzers with HART communications may be configured, operated, and calibrated using the HART Communicator.

The HART Communicator is used in two environments: Offline (not connected to an analyzer) and Online (connected to an analyzer). The Main menu (shown in Figure 1) is displayed when not connected to an analyzer. The Online Menu (shown in Figure 2) is displayed when connected to an analyzer.

Reference Documents

This document contains information on configuration, calibration, and operation of the 875 Series Analyzers using a HART Communicator. Additional information about the analyzers and the communicator is contained in the following documents:

Table 1. Reference Documents

Document	Description
MI 611-222	875CR Intelligent Electrochemical Analyzer for Contacting Conductivity and Resistivity Measurements
MI 611-225	875PH Intelligent Electrochemical Analyzer for pH, ORP, or Ion Selective Electrode (ISE) Measurement
MI 611-224	875EC Intelligent Electrochemical Analyzer for Electrodeless Conductivity Measurements
MI 020-484	HART Model 275 Communicator Messages

Overview of Top Level Menus

Figure 1 shows the Main menu structure of the HART Communicator. Figure 2 shows the top level Online menu for the 875 Series Analyzers.

1. Offline	Compile a set of configuration data for downloading to an analyzer or simulate an online connection to an analyzer without connecting to it.
2. Online	Configure, calibrate, or operate an online analyzer.
4. Frequency Device	Display the frequency output and pressure output of current to pressure devices.
5. Utility	Configure communicator parameters such as auto polling and adjusting contrast of communicator LCD. Also access to HART communicator simulation

Figure 1. HART Communicator Main Menu

1 Measure	Display the measurement (process variable) and related data.
2 Status	Display the measurement and system parameters
3 Hold	Hold the output at a determined value
4 Calibrate	Perform calibration functions.
5 Config	Perform configuration functions
6 Diag	Perform diagnostic functions
7 Logon Passcode	Enter the passcode

Figure 2. 875 Series Analyzers Top Level Online Menu

Connecting the Communicator to the Analyzer

Connect the communicator or other HART I/O communication device to the COM1 and COM2 terminals of the analyzer that are shown in MI 611-222, MI 611-224, or MI 611-225 supplied with the analyzer. There must also be a minimum of 250 Ω across the COM1 and COM2 terminals.

Communicator Keyboard and Display

Refer to the HART user manual supplied with the communicator.

Offline Configuration

The offline configuration feature is not available at this time.

Online Configuration

Refer to the following chapters:

875PH: Chapter 2

875CR: Chapter 3
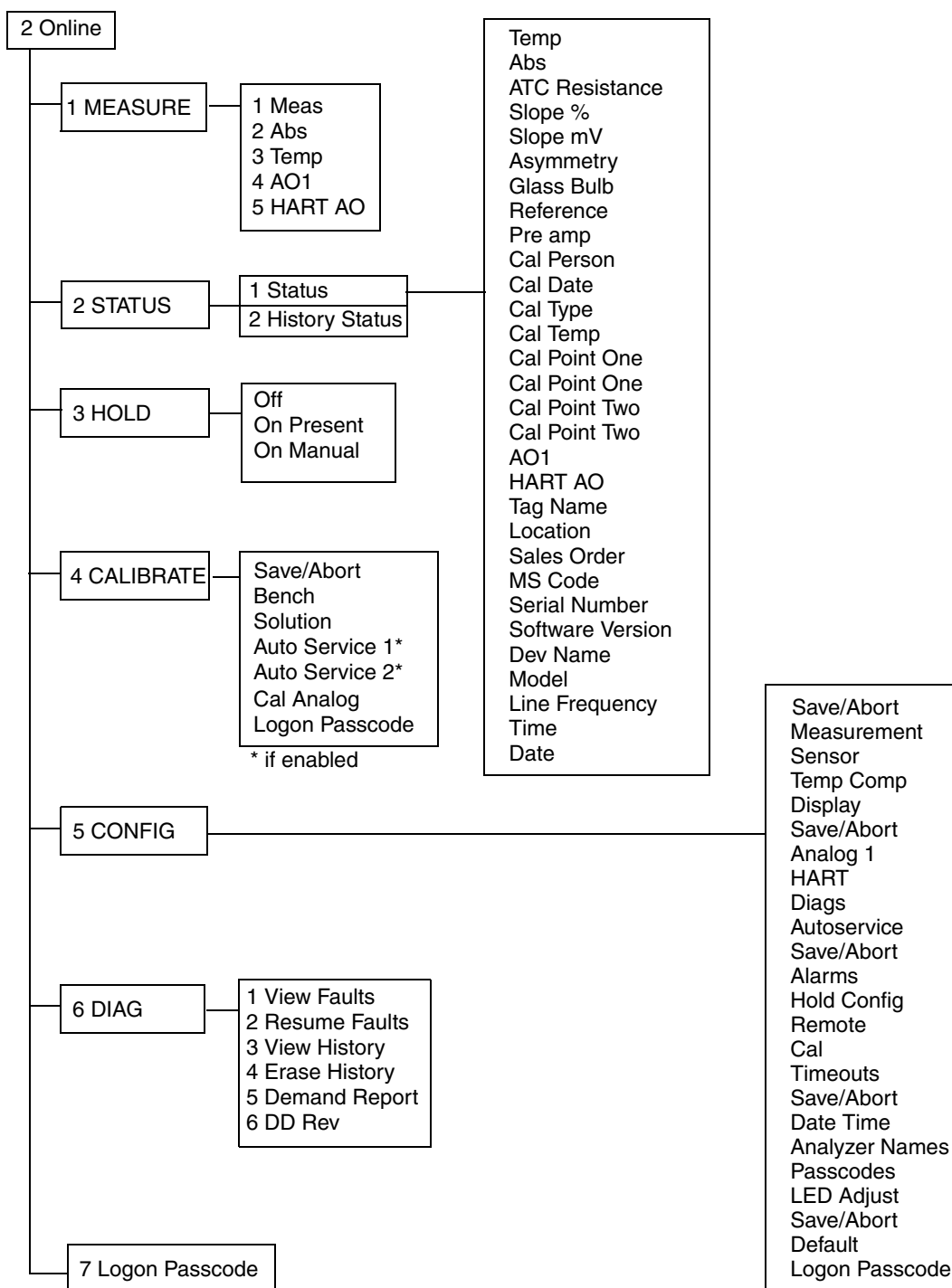
875EC: Chapter 4

2. 875PH Analyzer

Online Flowchart

```
2 Online

    1 MEASURE        1 Meas              Temp
                     2 Abs              Abs
                     3 Temp            ATC Resistance
                     4 AO1             Slope %
                     5 HART AO         Slope mV
                                       Asymmetry
                                       Glass Bulb
                                       Reference
                                       Pre amp
                                       Cal Person
    2 STATUS         1 Status          Cal Date
                     2 History Status  Cal Type
                                       Cal Temp
                                       Cal Point One
                                       Cal Point One
    3 HOLD           Off               Cal Point Two
                     On Present        Cal Point Two
                     On Manual         AO1
                                       HART AO
                                       Tag Name
                                       Location
                                       Sales Order
                                       MS Code
                                       Serial Number
    4 CALIBRATE      Save/Abort        Software Version
                     Bench             Dev Name
                     Solution          Model
                     Auto Service 1*   Line Frequency
                     Auto Service 2*   Time
                     Cal Analog        Date
                     Logon Passcode
                     * if enabled
                                                          Save/Abort
                                                          Measurement
                                                          Sensor
                                                          Temp Comp
                                                          Display
    5 CONFIG                                              Save/Abort
                                                          Analog 1
                                                          HART
                                                          Diags
                                                          Autoservice
                                                          Save/Abort
                                                          Alarms
                                                          Hold Config
    6 DIAG           1 View Faults                        Remote
                     2 Resume Faults                      Cal
                     3 View History                       Timeouts
                     4 Erase History                      Save/Abort
                     5 Demand Report                      Date Time
                     6 DD Rev                             Analyzer Names
                                                          Passcodes
                                                          LED Adjust
                                                          Save/Abort
                                                          Default
    7 Logon Passcode                                      Logon Passcode
```

Figure 3. Online Configuration Flowchart

Online Modes

Measurement

To display the measurement on the communicator, select **1 Measure** from the Online menu. The display will show:

1 Meas	The measurement value in engineering units.
2 Abs	The uncompensated measurement in millivolts.
3 Temp	The temperature measurement in engineering units.
4 A01	Analog Output 1 in mA.
5 HART AO	HART Analog Output in mA.

You can then select what you wish to display.

Status

To display the status on the communicator, select **2 Status** from the Online menu. You can then select to view the Current Status or the History Status and view the status of a number of parameters.

Hold

To access the Hold functions from the communicator, select **3 Hold** from the Online menu. Access requires you to have previously entered the proper passcode. You can then select **Off** to not use the Hold function, **Present** to hold all values and states at their current value, and **Manual** to set values and states at desired levels. In **Manual**, the Hold function does not take effect until all the values are entered.

Calibrate

To access the Calibration functions from the communicator, select **4 Calibrate** from the Online menu. Access requires you to enter the proper passcode. You can then select **Bench**, **Solution**, or **Cal Analog** calibration. You can also start **Auto Service 1** or **Auto Service 2** (if enabled). If you select **Cal Analog**, you must further define the output as **AO1** or **HART**.

> — NOTE —————————————
> If **Save/Abort** appears in the Calibration menu, there are configuration changes pending. **Save/Abort** must be selected before any calibration is allowed.

Configure

To access the Configuration functions from the communicator, select **5 Config** from the Online menu. Access requires you to enter the proper passcode. You can then configure a number of parameters from the menu that is presented.

> — NOTE —————————————
> Before leaving the Configure mode, you must activate **Save/Abort** if it is visible.

Diagnostics

To access the Diagnostic functions from the communicator, select **6 Diag** from the Online menu. You can then select **View Faults**, **Resume Faults**, **View History**, **Erase History**, **Demand Report**, or **DD Rev**. The proper passcode is required to suspend a fault or to erase the history log.

> ─ **NOTE** ──
> The DD Rev may not change with upgrade to subsequent firmware versions.

Logon Passcode

To access certain functions from the HART Communicator, you must enter the Level 1, Level 2, or Level 3 passcode (that was configured into the analyzer) into the HART Configurator. To do this, select **7 Logon Passcode** from the Online menu.

> ─ **NOTE** ──
> 7 Logon Passcode can also be used to 'lock' the analyzer by entering an invalid passcode.

Explanation of Parameters

See "Glossary of Online Parameters" on page 17.

3. 875CR Analyzer

Online Flowchart

```
┌──────────┐         ┌─────────────────┐
│ 2 Online │         │ Meas            │      ┌────────────────────────┐
└──────────┘         │ Abs             │      │ Temp                   │
                     │ Temp            │      │ Abs                    │
        ┌────────────┤ Meas 1*         │      │ ATC Resistance         │
        │ 1 MEASURE  │ Abs 1*          │      │ Temp 1*                │
        └────────────┤ Temp 1*         │      │ Abs 1*                 │
                     │ Meas 2*         │      │ ATC Resistance 1*      │
                     │ Abs 2*          │      │ Temp 2*                │
                     │ Temp 2*         │      │ Abs 2*                 │
                     │ Rej*            │      │ ATC Resistance 2*      │
                     │ Ratio*          │      │ Cal Person             │
                     │ Avg*            │      │ Cal Date               │
                     │ Diff*           │      │ Cal Type               │
                     │ AO1             │      │ Cal Temp               │
                     │ HART AO         │      │ AO1                    │
                     └─────────────────┘      │ HART AO                │
                                              │ Tag Name               │
        ┌────────────┐  ┌────────────────┐    │ Location               │
        │ 2 STATUS   ├──┤ 1 Status       │────│ Sales Order            │
        └────────────┘  ├────────────────┤    │ MS Code                │
                        │ 2 History Status│    │ Serial Number          │
                        └────────────────┘    │ Software Version       │
                                              │ Dev Name               │
        ┌────────────┐  ┌────────────────┐    │ Model                  │
        │ 3 HOLD     ├──┤ Off            │    │ Line Frequency         │
        └────────────┘  │ On Present     │    │ Time                   │
                        │ On Manual      │    │ Date                   │
                        └────────────────┘    └────────────────────────┘

        ┌──────────────┐ ┌─────────────────┐
        │ 4 CALIBRATE  ├─┤ 1 Bench         │
        └──────────────┘ │ 2 Solution      │
                         │ 3 Pure H2O      │
                         │ 4 Cust Temp     │
                         │ 5 Save/Abort    │
                         │ 6 Cal Analog    │
                         │ 7 Logon Passcode│
                         └─────────────────┘

        ┌────────────┐        ┌──────────────┐    ┌──────────────────┐
        │ 5 CONFIG   ├────────┤ Cell Mode    │    │ Measurement      │
        └────────────┘        │ Cell         │    │ Measurement 1*   │
                              │ Cell 1*      │    │ Measurement 2*   │
                              │ Cell 2*      │    │ Temp Comp        │
                              │ Save/Abort   │    │ Temp Comp 1*     │
                              │ No. Apps     │    │ Temp Comp 2*     │
                              │ Application  ├────│ Display          │
                              │ Remote       │    │ Analog 1         │
                              │ Cal          │    │ HART             │
        ┌────────────┐ ┌──────┤ Save/Abort   │    │ Alarm 1          │
        │ 6 DIAG     ├─┤ 1 View Faults │     │    │ Alarm 2          │
        └────────────┘ │ 2 Resume Faults│ Hold Config │ Logon Passcode │
                       │ 3 View History│ Diags    │    └──────────────────┘
                       │ 4 Erase History│ Timeout │
                       │ 5 Demand Report│ Date Time │
                       │ 6 DD Rev      │ Save/Abort │
                       └───────────────┤ Analyzer Names │
                                       │ Passcodes     │
                                       │ LCD Adjust    │
                                       │ Default       │        * Dual Cell Only
        ┌──────────────────┐           │ Save/Abort    │
        │ 7 Logon Passcode │           │ Logon Passcode│
        └──────────────────┘           └───────────────┘
```
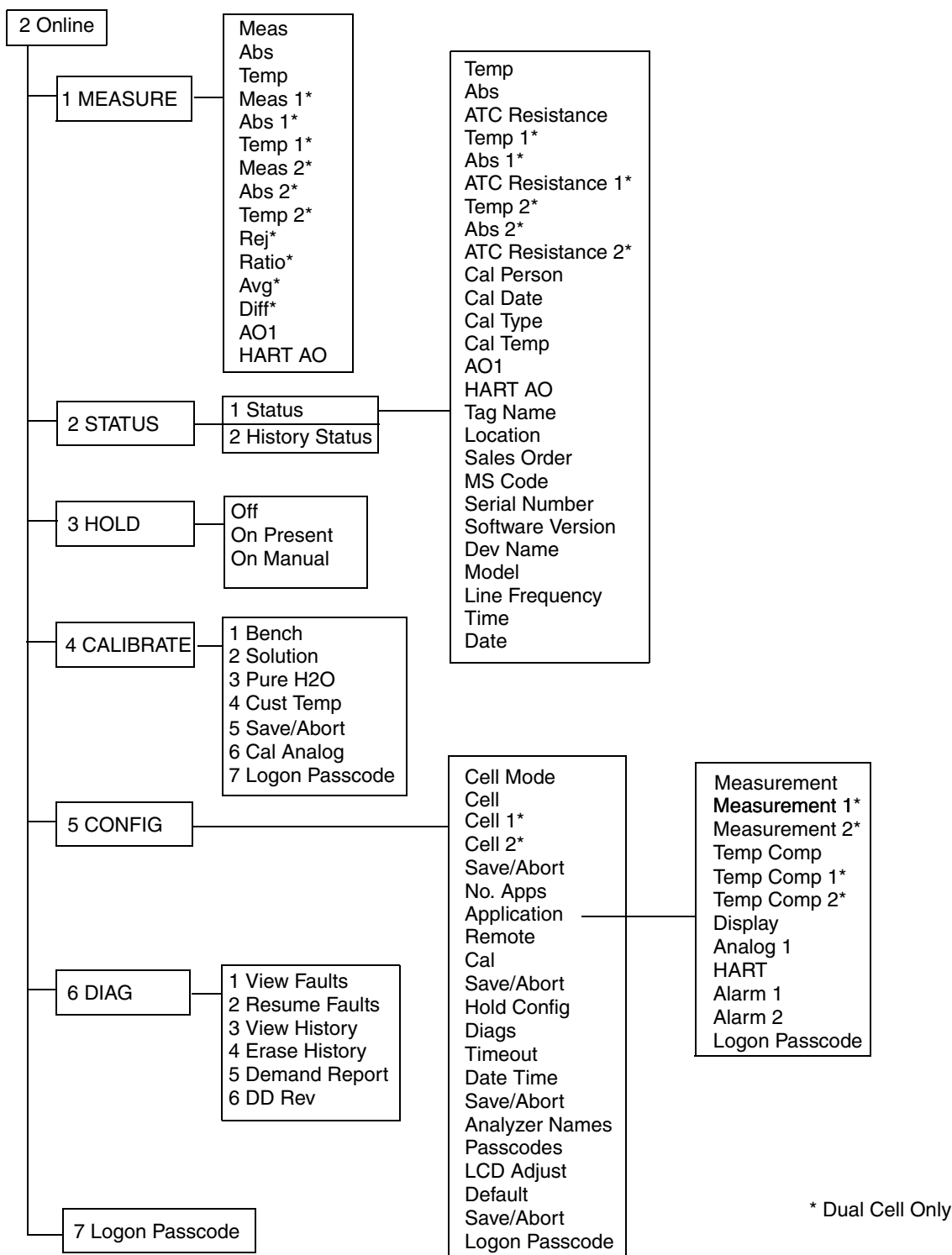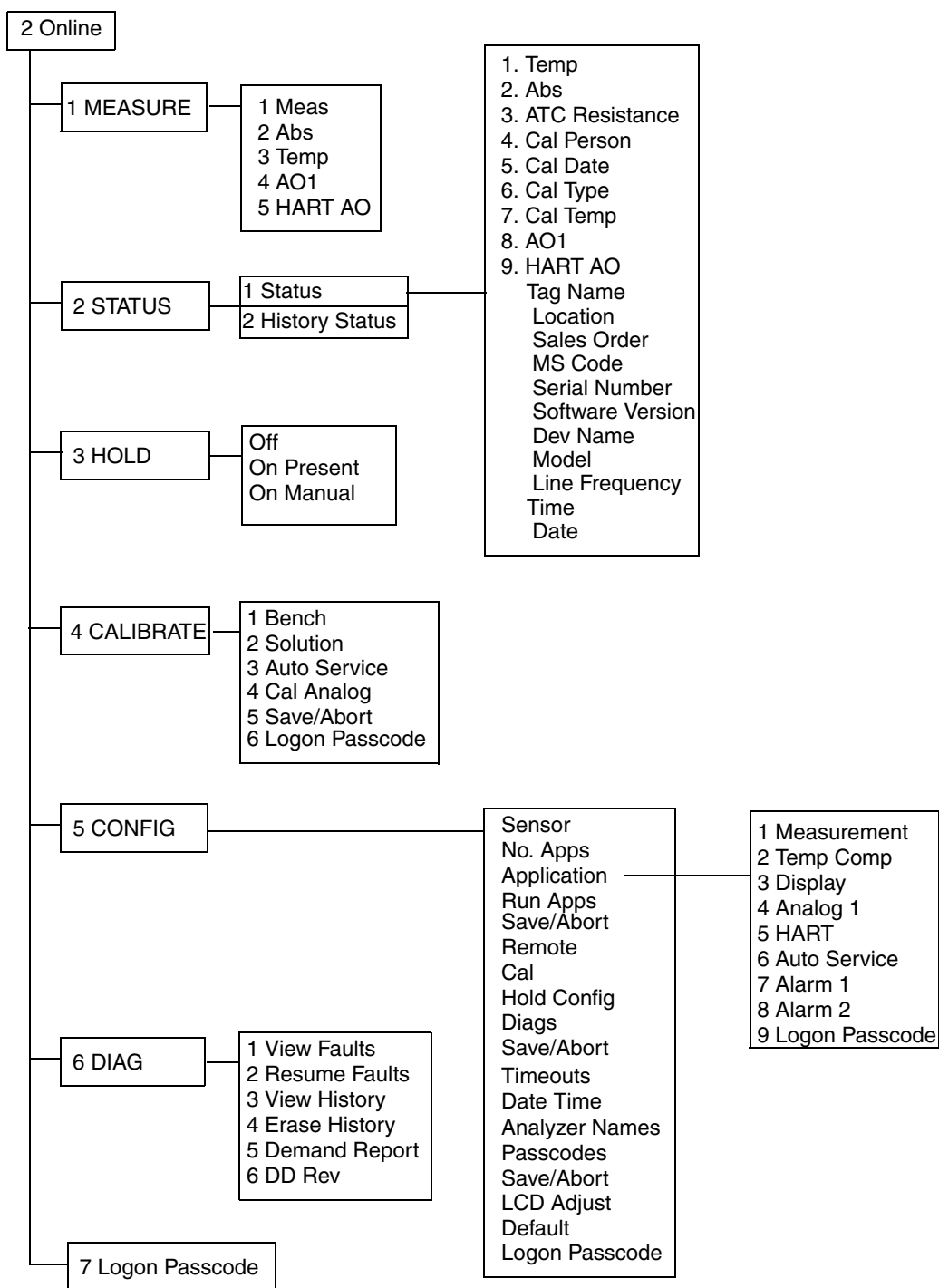
Figure 4. Online Configuration Flowchart

Online Modes

Measurement

To display the measurement on the communicator, select **1 Measure** from the Online menu. The display will show:

Meas*	The measurement value in engineering units.
Abs*	The uncompensated measurement in millivolts.
Temp*	The temperature measurement in engineering units.
Rej	The percent rejection if dual cell.
Ratio	The measurement ratio if dual cell.
Avg	The average measurement of the two cells if dual cell.
Diff	The measurement difference of the two cells if dual cell.
A01	Analog Output 1 in mA.
HART AO	HART Analog Output in mA.

*For both Cell 1 and Cell 2 if dual cell.

You can then select what you wish to display.

Status

To display the status on the communicator, select **2 Status** from the Online menu. You can then select to view the Current Status or the History Status and view the status of a number of parameters.

Hold

To access the Hold functions from the communicator, select **3 Hold** from the Online menu. Access requires you to have previously entered the proper passcode. You can then select **Off** to not use the Hold function, **Present** to hold all values and states at their current value, and **Manual** to set values and states at desired levels. In **Manual**, the Hold function does not take effect until all the values are entered.

Calibrate

To access the Calibration functions from the communicator, select **4 Calibrate** from the Online menu. Access requires you to enter the proper passcode. You can then select **Bench**, **Solution**, **Pure H2O**, **Cust Temp**, or **Cal Analog** calibration. If you select **Cal Analog**, you must further define the output as **AO1** or **HART**.

> — **NOTE** —
> If **Save/Abort** appears in the Calibration menu, there are configuration changes pending. **Save/Abort** must be selected before any calibration is allowed.

Configure

To access the Configuration functions from the communicator, select **5 Config** from the Online menu. Access requires you to enter the proper passcode. You can then configure a number of parameters from the menu that is presented.

> — **NOTE** ————————————————————————————————
> Before leaving the Configure mode, you must activate **Save/Abort** if it is visible.

Diagnostics

To access the Diagnostic functions from the communicator, select **6 Diag** from the Online menu. You can then select **View Faults**, **Resume Faults**, **View History**, **Erase History**, **Demand Report**, or **DD Rev**. The proper passcode is required to suspend a fault or to erase the history log.

> — **NOTE** ————————————————————————————————
> The DD Rev may not change with upgrade to subsequent firmware versions.

Logon Passcode

To access certain functions from the HART Communicator, you must enter the Level 1, Level 2, or Level 3 passcode (that was configured into the analyzer) into the HART Configurator. To do this, select **7 Logon Passcode** from the Online menu.

> — **NOTE** ————————————————————————————————
> 7 Logon Passcode can also be used to 'lock' the analyzer by entering an invalid passcode.

Explanation of Parameters

12

4. 875EC Analyzer

Online Flowchart

```
2 Online
   │
   ├── 1 MEASURE ──── 1 Meas              1. Temp
   │                  2 Abs               2. Abs
   │                  3 Temp              3. ATC Resistance
   │                  4 AO1               4. Cal Person
   │                  5 HART AO           5. Cal Date
   │                                      6. Cal Type
   │                                      7. Cal Temp
   │                                      8. AO1
   ├── 2 STATUS ───── 1 Status            9. HART AO
   │                  2 History Status       Tag Name
   │                                         Location
   │                                         Sales Order
   │                                         MS Code
   │                                         Serial Number
   │                                         Software Version
   ├── 3 HOLD ─────── Off                     Dev Name
   │                  On Present               Model
   │                  On Manual               Line Frequency
   │                                       Time
   │                                         Date
   │
   ├── 4 CALIBRATE ── 1 Bench
   │                  2 Solution
   │                  3 Auto Service
   │                  4 Cal Analog
   │                  5 Save/Abort
   │                  6 Logon Passcode
   │
   ├── 5 CONFIG ──────────────── Sensor          1 Measurement
   │                             No. Apps         2 Temp Comp
   │                             Application ──── 3 Display
   │                             Run Apps         4 Analog 1
   │                             Save/Abort       5 HART
   │                             Remote           6 Auto Service
   │                             Cal              7 Alarm 1
   │                             Hold Config      8 Alarm 2
   │                             Diags            9 Logon Passcode
   │                             Save/Abort
   ├── 6 DIAG ─────── 1 View Faults        Timeouts
   │                  2 Resume Faults      Date Time
   │                  3 View History       Analyzer Names
   │                  4 Erase History      Passcodes
   │                  5 Demand Report      Save/Abort
   │                  6 DD Rev             LCD Adjust
   │                                       Default
   │                                       Logon Passcode
   └── 7 Logon Passcode
```

Figure 5. Online Configuration Flowchart

13

Online Modes

Measurement

To display the measurement on the communicator, select **1 Measure** from the Online menu. The display will show:

1 Meas	The measurement value in engineering units.
2 Abs	The uncompensated measurement in millivolts.
3 Temp	The temperature measurement in engineering units.
4 A01	Analog Output 1 in mA.
5 HART AO	HART Analog Output in mA.

You can then select what you wish to display.

Status

To display the status on the communicator, select **2 Status** from the Online menu. You can then select to view the Current Status or the History Status and view the status of a number of parameters.

Hold

To access the Hold functions from the communicator, select **3 Hold** from the Online menu. Access requires you to have previously entered the proper passcode. You can then select **Off** to not use the Hold function, **Present** to hold all values and states at their current value, and **Manual** to set values and states at desired levels. In **Manual**, the Hold function does not take effect until all the values are entered.

Calibrate

To access the Calibration functions from the communicator, select **4 Calibrate** from the Online menu. Access requires you to enter the proper passcode. You can then select **Bench**, **Solution**, or **Cal Analog** calibration. If you select **Cal Analog**, you must further define the output as **AO1** or **HART**.

> — **NOTE** —————————————————————————————
> If **Save/Abort** appears in the Calibration menu, there are configuration changes pending. **Save/Abort** must be selected before any calibration is allowed.

Configure

To access the Configuration functions from the communicator, select **5 Config** from the Online menu. Access requires you to enter the proper passcode. You can then configure a number of parameters from the menu that is presented.

> — **NOTE** —————————————————————————————
> Before leaving the Configure mode, you must activate **Save/Abort** if it is visible.

Diagnostics

To access the Diagnostic functions from the communicator, select **6 Diag** from the Online menu. You can then select **View Faults**, **Resume Faults**, **View History**, **Erase History**, **Demand Report**, or **DD Rev**. The proper passcode is required to suspend a fault or to erase the history log.

> ─ **NOTE** ───
> The DD Rev may not change with upgrade to subsequent firmware versions.

Logon Passcode

To access certain functions from the HART Communicator, you must enter the Level 1, Level 2, or Level 3 passcode (that was configured into the analyzer) into the HART Configurator. To do this, select **7 Logon Passcode** from the Online menu.

> ─ **NOTE** ───
> 7 Logon Passcode can also be used to 'lock' the analyzer by entering an invalid passcode.

Explanation of Parameters

5. *Glossary of Online Parameters*

Parameter	Explanation	Applicable Analyzers
Measure Mode		
Abs	Displays the absolute (uncompensated) measurement	CR, EC, PH
AO1 [a]	Displays the Analog Output 1 measurement in mA or volts	CR, EC, PH
Avg	Displays the average measurement of (cell 1 + cell 2) / 2	CR

Diff	Displays the measurement difference
	    For conductivity, cell 1 - cell 2
	    For resistivity, cell 2 - cell 1
		CR

HART AO [a]	Displays the HART Analog Output measurement in mA	CR, EC, PH
Meas	Displays the measurement in specified engineering units	CR, EC, PH

Ratio	Displays the measurement ratio
	    For conductivity, (cell 2 / cell 1) x 100
	    For resistivity, (cell 1 / cell 2) x 100
		CR

Rej	Displays the percent rejection
	    For conductivity, [1- (cell 2 / cell 1)] x 100
	    For resistivity, [1- (cell 1 / cell 2)] x 100
		CR

Temp	Displays the process temperature measurement in specified engineering units	CR, EC, PH
Status Mode [b]		
Abs	Displays the absolute measurement	CR, EC, PH
AO1	Displays the value of Analog Output 1 in mA or volts	CR, EC, PH
Asymmetry	Displays the asymmetry potential (mV difference between the theoretical isopotential point and the actual point due to the most recent calibration	PH
ATC Resistance	Displays the resistance of the temperature compensator	CR, EC, PH
Cal Date	Displays the date of the last calibration in the form mm/dd/yy	CR, EC, PH
Cal Person	Displays the name of the last calibrator	CR, EC, PH
Cal Point One	Displays the values at calibration point one in pH and then in mV	PH
Cal Point Two	Displays the values at calibration point two in pH and then in mV	PH
Cal Temp	Displays the temperature calibration type of last calibration (default, custom, solution, failsafe, manual)	CR, EC, PH
Cal Type	Displays the type of the last calibration (bench, solution, factory default)	CR, EC, PH
Date	Displays the current date	CR, EC, PH
Dev Name	Displays the device name of the analyzer	CR, EC, PH
Glass Bulb	Displays the glass bulb resistance	PH
HART AO	Displays the HART analog output in mA	CR, EC, PH

17

Parameter	Explanation	Applicable Analyzers
History Status	Displays up to 10 of the most current history log entries (if present)	CR, EC, PH
Line Frequency	Displays the ac line frequency of the analyzer	CR, EC, PH
Location	Displays the location of the measurement	CR, EC, PH
Model	Displays the model number of the analyzer	CR, EC, PH
MS Code	Displays the analyzer model code	CR, EC, PH
Pre amp	Displays the preamplifier power	PH
Reference	Displays the reference junction resistance	PH
Sales Order	Displays the analyzer sales order number	CR, EC, PH
Serial Number	Displays the analyzer serial number	CR, EC, PH
Slope %	Displays the deviation in percent of the slope of the most recent calibration compared to the standard	PH
Slope mV	Displays the change in the mV/pH or mV/decade of the most recent calibration	PH
Software Version	Displays the software version of the analyzer	CR, EC, PH
Status	Displays the current status of the analyzer	CR, EC, PH
Tag Name	Displays the tag name of the analyzer	CR, EC, PH
Temp	Displays the process temperature of the sensor	CR, EC, PH
Time	Displays the current time	CR, EC, PH
Hold Mode		
Off	Used to release the analyzer from Hold state	CR, EC, PH
On Manual	Used to hold all values and states at desired levels	CR, EC, PH
On Present	Used to hold all values and states at their current level	CR, EC, PH
Calibrate Mode [c]		
Auto Service n	Used to perform an automatic cleaning of the sensor and/or a 1-point or 2-point calibration as configured	PH, EC
Bench	Used to perform a calibration using theoretical inputs or to return to the stored factory default calibration	CR, EC, PH
Cal Analog	Used to tune the 4 mA and 20 mA values of the AO1 or HART analog outputs	CR, EC, PH
Logon Passcode	Used to enter the passcode to access Calibration mode	CR, EC, PH
Pure H2O	Used to perform a pure water calibration.	CR
Solution	Used to perform a calibration using real solutions	CR, EC, PH
Config Mode		
Alarms	Used to specify each alarm to represent measurement, temperature, absolute, or a fault and then subparameters associated with each	CR, PH, EC
Analog 1	Used to specify the Analog 1 output to represent measurement, temperature, or absolute; minimum (LRV) and maximum (URV) range values; and failsafe output	CR, PH, EC
Analyzer Names [e]	Used to specify the tag number, tag name, location, and device name	CR, EC, PH

Parameter	Explanation	Applicable Analyzers
Application	Used to specify the measurement, display, temperature compensation, output, and alarm configuration for each application.	CR, EC
Auto Service [d]	Used to configure auto service related parameters	PH, EC
Cal	Used to specify the options to be used with a solution calibration	CR, EC, PH
Cell	Used to specify the cell constant and temperature features for all three applications	CR
Cell Mode	Used to specify cell mode as Single, Dual, or Redundant	CR
Datetime	Used to set the date and time for the real time clock	CR, EC, PH
Default	Used to reset the configuration back to the factory default values	CR, EC, PH
Diags	Used to specify what fault messages can appear on your display	CR, EC, PH
Display	Used to configure the display as single, dual, or scan and then subparameters associated with each	CR, PH, EC
HART	Used to specify the HART output to represent measurement, temperature, or absolute; minimum (LRV) and maximum (URV) range values; and failsafe output. Also used to specify the Polling Address and the Preambles value.	CR, PH, EC
Hold Config	Used to configure all values and states to be held at their current level (On Present) or at a desired level (On Manual) when triggered by a digital signal or when going into Calibration or Configuration mode	CR, EC, PH
LED Adjust	Used to adjust the brightness of the front panel display	CR, EC, PH
Logon Passcode	Used to enter the passcode to access Configuration mode	CR, EC, PH
Measurement	Used to configure units, damping, and other measurement parameters	CR, PH, EC
No. Apps	Used to specify the number of applications you wish to preconfigure.	CR, EC
Passcodes	Used to establish or change the Level 1, 2, and 3 passcodes	CR, EC, PH
Remote	Used to configure parameters associated with a remote personal computer or RS232 printer	CR, EC, PH
Run Apps	Used to switch form one application to another	CR, EC
Sensor	Used to configure sensor related parameters	PH, EC
Temp Comp	Used to configure the temperature compensation for the chemical being measured	CR, PH, EC
Timeouts	Used to specify the time for front panel, remote, and digital communication timeouts	CR, EC, PH
Diag Mode		
DD Rev	Used to display the DD version	CR, EC, PH
Demand Report	Used to send the history log out to the remote RS232 port	CR, EC, PH
Erase History	Used to erase the history log (requires Level 1 passcode)	CR, EC, PH

Parameter	Explanation	Applicable Analyzers
Logon Passcode	Used to enter the passcode to perform functions requiring a passcode	CR, EC, PH
Logon Passcode Mode		CR, EC, PH
Resume Faults	Used to resume any suspended faults	CR, EC, PH
View Faults	Used to view any faults and possibly suspend each fault	CR, EC, PH
View History	Used to view the diagnostic history	CR, EC, PH

(a) If configured **Off**, display reads **NaN.**

(b) At message "Ignore next 50 occurrences of status?", reply "YES".

(c) If a disconnect occurs during calibration, recycle power or attempt another calibration.

(d) Auto Service monthly must schedule days 16 at a time in two entries.

(e) Use upper case letters for Tag Number.